

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF MINES

Health and Safety
District C

Welch, West Virginia
August 19, 1960 ras

Memorandum

To: J. S. Malesky, District Supervisor, District I

From: J. L. Gilley, Mining Health and Safety Engineer

Subject: Report on investigation of minor coal outburst (bump) Moss No. 2 mine, Clinchfield Coal Company, Clinchfield, Virginia

A coal outburst (bump) occurred in No. 5 room 5 left 3 east pillar section of the subject mine at 4:30 a.m., July 13, 1960, and injured a cutting-machine operator, his helper and the section foreman. The cutting-machine operator suffered a broken right thigh and was hospitalized. The cutting-machine operator's helper and the section foreman received minor contusions and abrasions which did not require hospitalization. The other 7 employees on the section were not injured.

During this investigation, the writer was accompanied and assisted by Messrs. James Nixon, chairman, mine safety committee, R. T. Huffman, production manager, J. A. Cable, division superintendent, F. W. Johnson, mine superintendent, Owen Blackstone, general mine foreman, and W. R. Stewart, Federal coal-mine inspector, Norton, Virginia.

The Moss No. 2 mine is opened by a 14-degree slope 500 feet in length and 2 shafts, 90 and 320 feet in depth, respectively. The mine operates in the high-volatile bituminous Tiller coal bed, which averaged 52 inches in thickness on the property; however, the thickness of the coal bed in the immediate vicinity of the outburst ranged from 72 to 96 inches; coal height was 76 inches in No. 5 room where the accident occurred and contained 2 bands of shale impurities, one 7 to 10 inches thick about 9 inches from the roof and the other band situated near mid-seam height was 2 to 4 inches thick. Face and butt cleavage planes in the Tiller coal bed are not prominent. An average daily production of 8,000 tons of coal was loaded with mobile loading machines into shuttle cars. The mine, which is rated gassy, has not experienced a major disaster, and reportedly, the coal outburst on July 13, 1960, was the first such occurrence of any consequence.

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Development and pillar extraction was by a room-and-pillar method. Present projections for development for main, cross, and room-panel entries were in groups, ranging from 5 to 10 in number. Entries and rooms were on 60-foot centers and ranged from 14 to 20 feet in width. Crosscuts were driven at intervals of about 60 feet.

Pillars were fairly uniform in dimensions, as will be noted from the attached sketches of the area involved. Extraction of the pillars was accomplished by taking a single open-end lift from either the room or the crosscut side of the pillars; alternate lifts were not usually driven simultaneously in the same pillar. Slabbing of pillars for roadways in 5 left 3 east was not resorted to as a practice. A modified 45-degree angle pillar line is practiced in mining the pillars, and the extraction line does not exceed 800 feet.

The maximum depth of the cover over the 5 left 3 east area was 900 feet and contained intermittent stratum of sandstone ranging from a few feet up to about 60 feet in thickness. The main roof, which contacted the coal in the immediate area involved, was predominately fine-grained sandstone ranging up to 25 feet in thickness; however, localized dispositional changes in the structure of the immediate roof have frequently been encountered in the 5 left 3 east territory. Caving of the roof in the mined-out area occurred within a reasonable time subsequent to complete extraction of the individual pillars and in some cases upon completion of the lifts in some of the pillars. Cantilevering roof, however, was observed extending for approximately 100 feet into the 4 left mined-out area in by the location where the No. 3 room in 5 left would have holed through.

The floor to a depth of 3 to 5 feet or more in the area involved was hard, dense gray shale that heaves when subjected to abnormal mining pressures, a condition observed in the old No. 6 room roadway, 60 feet in by the scene of the outburst. The floor had not heaved in either of the 5 rooms.

Methods of roof support in 5 left 3 east consisted of posts, 3-piece timber sets and roof bolts installed in accordance with recommended procedure, or combinations of these methods depending upon conditions. Roof bolts, however, were used exclusively for roof support in the 5 rooms being developed in 5 left 3 east at the time of this investigation. The roof bolts, from all indications, were doing a very satisfactory job. Roof was not thrown or shaken down at the scene of the outburst.

It is probably well to mention at this time that a decision was made in March 1960, because of a ventilation problem, to discontinue mining temporarily in the 5 left 3 east section until the adjacent outby 4 left pillar section was completed. However, before mining in 5 left was discontinued as planned, an effort was made to "flatten" the extraction line and discontinue development of the 5 rooms (See Sketch A) so as to presumably minimize impingement of stresses on the pillars and to prevent, insofar as possible,

the roof from being affected adversely during the period the section would remain idle. But unfortunately, 4 of the 5 rooms being developed had advanced to within an abutment zone, or probably to the most highly stressed portion of the room-panel block when mining was discontinued. Extent of extraction and development in the 5 left 3 east section, when mining was discontinued in March 1960, is shown in Sketch A, attached hereto. It is well to point out that Nos. 2, 3, 4, and 5 rooms had been driven nearly abreast, as indicated in Sketch A, within the abutment zone directly toward the adjacent 4 left mined-out area.

The 4 left 3 east section was completed in June 1960, just prior to the miners' vacation period, and the 5 left 3 east section was reactivated on July 12, 1960, following the miners' vacation. The outburst occurred on the mid-night - 8 a.m., shift at 4:30 a.m., July 13, 1960, in No. 5 room, one of the 5 rooms, reportedly, being driven to re-establish the normal pillar line. Location of the faces of the 5 rooms and the location of the men and equipment, at the time of the outburst, are indicated in Sketch B. It will be noted that the No. 1 room lacked 90 feet from being completed, the No. 2 room 40 feet, No. 3 room 30 feet, No. 4 room 33 feet, and No. 5 room 50 feet. The men performing work nearest the working faces at the time of the outburst were the loading-machine crew, the cutting-machine crew, the shot firer and the section foreman.

A short time prior to the outburst, a cut of coal had just been loaded in No. 1 room, the coal at the face of No. 2 room had been cleaned up and the roof bolted. A cut of coal (third cut) had been blasted in No. 3 room crosscut, and the face of No. 4 room crosscut had been cut and drilled (second cut in this crosscut) as indicated in Sketch B. The shot firer had charged the 4 boreholes that had been drilled to a depth of about 7 feet in the lower half of the coal bed. Each borehole was charged with 5 or 6 cartridges of explosives. The cutting-machine crew had just completed cutting and drilling the face of No. 5 room. At the time the outburst occurred, the cutting-machine crew had trammed the cutting machine (LLRU Joy) back from the face to the position indicated in No. 5 room when the section foreman arrived. (See Sketch B) The foreman instructed the machine crew to leave the cutting machine parked at that location and go eat their lunch. In the meantime after connecting the blasting cable to the 4 charged shots in No. 4 room crosscut, the shot firer unrolled the cable outby to a position around the corner of the last open crosscut between Nos. 4 and 5 rooms and to within 50 feet of where the cutting-machine crew and the section foreman were conferring. Reportedly, after calling "fire" three times, he detonated the shots. The 4 shots were detonated simultaneously and according to witnesses interviewed, the coal outburst occurred almost instantaneously after the blasting.

Effects of the bump were confined to Nos. 4 and 5 rooms, as indicated in Sketch B, with the greatest forces being expanded on the left side of the pillar next to the face of No. 5 room and to a lesser degree in the face of No. 5 room. The opposite pillar (right side) in No. 5 room was not affected. Approximately 10 tons of coal were thrown from the right side

of the pillar next to the face in No. 4 room. The shock from the ultimate failure of the left side of the pillar in No. 5 room was sufficiently intense to expel coal from the entire length of the pillar to a depth of 2-1/2 feet at the center of the roadway. A cavity 4 to 6 inches in height, 6 feet in length and extending about 6 feet over the coal pillar resulted from the comparatively violent explosion of the coal. Insofar as could be determined, the roof and floor were not affected. A dense cloud of dust was thrown into suspension and, reportedly, methane gas was liberated which was soon swept away after line brattices and the check curtain in No. 5 room were repaired. About 8 tons of coal was loaded before the cutting machine could be trammed out of No. 5 room.

At the time of the outburst, the cutting-machine operator and his helper were just outby the controls on the left side of the machine, and between the machine and left rib, the section foreman was about 5 feet outby the end of the machine and thus in the open intersection. The cutting machine operator and his helper were thrown against the frame of the machine by the pressure wave and the outrush of coal and were partly covered by the dislodged canvas line brattice and coal. Workmen rushed to their aid and soon extricated them. The section foreman was knocked down by the pressure wave. The three employees, after receiving first-aid treatment, were taken to the surface, where they were examined by a doctor. The cutting-machine operator was hospitalized, but the cutting-machine operator's helper and the section foreman did not require hospitalization.

Circumstances under which this coal-mine bump occurred are evidence that a combination of natural conditions favorable for such occurrences exists in certain areas in this mine. Obviously, this combination in conjunction with other factors such as mining methods and practices that tend to accentuate rather than minimize overstressing or the impingement of forces in active pillar areas is most likely to cause bumps or outbursts with varying degrees of violence.

Maximum cover over the coal at this property is about 900 feet. The immediate area in the 5 left 3 east territory (and other areas) is overlain with thickly bedded sandstone which in turn is overlain by several beds of massive rock. It was further determined that the mine floor, especially in the area involved, was a hard, dense shale that resisted heaving. These salient factors undoubtedly had subjected certain portions of the room-panel block being developed, particularly along the back side (gob side), to comparatively high stresses that extended for a considerable distance within the block. From the attached sketches, it will be noted that 5 rooms on 60-foot centers were being developed in the manner and direction indicated. Furthermore, this development was being done toward a mined-out area within the front abutment zone or into an area of the block most likely to be highly stressed by superimposed abutment loading from the 4 left and the 5 left gob areas. The fact that the 5 left pillar section had been idle for 4 months probably permitted additional stress upon the pillar line point where the greatest percentage of outbursts occur.

Reportedly, light bumps incidental to or normal in pillar mining occur in this mine, but bumps with sufficient intensity to expel coal from the faces and periphery of coal pillars have not occurred.

It is well to reiterate that development of several rooms abreast (or even nearly abreast) in a highly stressed pillar block toward an old gob area in the presence of natural conditions favorable for bumps, is not in accordance with accepted practices to minimize occurrences of coal outburst. Pillar mining in the presence of natural conditions favorable for outbursts requires that all necessary precautions be taken through proper mining methods and practices to avoid critical areas and thus minimize the occurrence and severity of outbursts.

It is the opinion of the author that this minor coal-mine outburst accident was the result of an accumulative process from a combination of the above-mentioned factors, and the following recommendations are offered with the hope that the occurrence and the severity of outbursts, if not eliminated, will be minimized:

1. The system of mining should include a plan that will produce a minimum of critical areas during pillar mining.
2. Under no circumstance, where the natural conditions are conducive to or favorable for outbursts, should groups of rooms (such as those involved) be driven or be developed abreast (or even nearly so) into highly stressed areas (abutment zones) of coal pillars toward old gob areas.
3. Complete extraction of pillars should be striven for and pillar remnants that could be mined safely should not be left in the gobs. If it is not possible to recover such pillar remnants, their load-carrying capacity should be destroyed.
4. Pillars should be recovered in proper sequence so as to maintain a reasonably straight fracture line. Irregular pillar extraction alignment results in excessive pressures on points jutting into the jobs. Experience has shown, however, that the lead end (top end) of a pillar line can be kept slightly in advance (flat).
5. Ample warning should be given before shots are fired, and precautions should be taken to ascertain that all persons are in the clear. Men should be removed from adjoining working places when there is not only danger of shot blowing through, but in all pillar places as well, where there is danger of blasting initiating a coal-mine bump as occurred in the 5 left 3 east section of this mine.

Following this investigation, Mr. R. T. Huffman, production manager, expressed a desire and requested the services of the author to make a survey in other mines of the company for the purpose of examining pillar mining conditions and determining whether or not conditions and practices that could produce outbursts exist. This survey has been started as requested. The officials are commended for stopping the 5 left section until the investigation was completed and for complying with the writers suggestions in reactivating the section following the investigation.

The writer wishes to acknowledge the courtesies extended and the assistance given by James Nixon, chairman of the mine safety committee, and the officials of the Clinchfield Coal Company particularly Messrs. Earl Holbrook, section foreman, Owen Blackstone, general mine foreman, F. W. Johnson, mine superintendent, J. A. Cable, division superintendent, and R. T. Huffman, production manager.

/s/ J. L. Gilley

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Mining Health and Safety Engineer

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